

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 00/00248

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E01F15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 03453 A (BRUSCHI STEFANO ;MALGARINI MAURO (IT); AUTOSTRADE CONCESS CONST (I) 2 February 1995 (1995-02-02) page 2, line 1 - line 7 page 5, line 6 -page 7, line 7 page 12, line 19 - line 28; figures —	1,2,5,7, 8,18
A	US 3 844 538 A (COLAN O) 29 October 1974 (1974-10-29) column 2, line 30 -column 3, line 22; figures —	15,16
X	BE 644 358 A (E. BUCHER) 9 July 1964 (1964-07-09) page 3, paragraph 3 -page 5, paragraph 4 page 6, paragraph 7 -page 9, paragraph 3; figures —	1,2
Y		3-5,10
A		1,11,14
		13,15,19
		2,8,17
		—/—

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents :

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

10 October 2000

17/10/2000

Name and mailing address of the ISA

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Authorized officer

Verveer, D

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IT 00/00248

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 681 302 A (THOMPSON MARION L) 21 July 1987 (1987-07-21) column 5, line 47 -column 6, line 39	3-5, 10, 15
A	column 8, line 22 - line 31 column 14, line 17 - line 51; figures	1, 11, 12, 14, 18, 19
Y	GB 1 347 771 A (ETAT FRANCAIS MINISTERE DE LEQ) 27 February 1974 (1974-02-27) page 3, line 43 - line 51; figures	13
A	—	11
Y	EP 0 518 304 A (FIMIT IPSE SRL) 16 December 1992 (1992-12-16) column 2, line 14 - line 34; figures	19
A	—	1, 10, 11
A	DE 22 00 183 A (KOERTJE WERNER DR ING) 19 July 1973 (1973-07-19) the whole document	1, 3
A	—	1, 4
A	DE 74 20 685 U (H.J. SCHÖMBURG) 31 October 1974 (1974-10-31) the whole document	—
A	—	1, 10, 11, 15
A	DE 15 34 499 A (A. GROS) 26 June 1969 (1969-06-26) the whole document	—
A	DE 25 13 436 A (VOEST AG) 2 October 1975 (1975-10-02) page 3, paragraph 2; figures	5
A	PATENT ABSTRACTS OF JAPAN vol. 014, no. 407 (M-1019), 4 September 1990 (1990-09-04) -& JP 02 157308 A (KYOKUTO KOGEN CONCRETE SHINKO KK), 18 June 1990 (1990-06-18) abstract	8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT 00/00248

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9503453	A 02-02-1995	IT 1262381	B	19-06-1996
		AT 160402	T	15-12-1997
		AU 6980694	A	20-02-1995
		DE 69406930	D	02-01-1998
		DE 69406930	T	18-06-1998
		EP 0710309	A	08-05-1996
		ES 2111932	T	16-03-1998
		US 5697728	A	16-12-1997
US 3844538	A 29-10-1974	NONE		
BE 644358	A 09-07-1964	DE 1459806	A	21-11-1968
		LU 45554	A	28-04-1964
		NL 6401880	A	31-08-1964
US 4681302	A 21-07-1987	EP 0297182	A	04-01-1989
		AT 81534	T	15-10-1992
		DE 3782249	D	19-11-1992
		DE 3782249	T	11-03-1993
		CA 1214347	A	25-11-1986
GB 1347771	A 27-02-1974	FR 2086626	A	31-12-1971
		AT 319318	B	10-12-1974
		BE 765151	A	01-10-1971
		CH 539739	A	14-09-1973
		DE 2116060	A	21-10-1971
		ES 196139	Y	01-07-1975
		NL 7104475	A,C	05-10-1971
		SE 361695	B	12-11-1973
EP 0518304	A 16-12-1992	IT 223209	Z	13-06-1995
DE 2200183	A 19-07-1973	NONE		
DE 7420685	U 31-10-1974	NONE		
DE 1534499	A 26-06-1969	NONE		
DE 2513436	A 02-10-1975	AT 330234	B	25-06-1976
		AT 258974	A	15-09-1975
		BG 28349	A	15-04-1980
		CH 587968	A	31-05-1977
		CS 198371	B	30-06-1980
		NO 751080	A,B,	30-09-1975
		SE 398250	B	12-12-1977
		SE 7503617	A	29-09-1975
JP 02157308	A 18-06-1990	JP 1905965	C	24-02-1995
		JP 6029492	B	20-04-1994

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference DE/EM/A3333	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/IT 00/00248	International filing date (day/month/year) 15/06/2000	(Earliest) Priority Date (day/month/year) 21/07/1999
Applicant		

AUTOSTRADE CONCESSIONI E COSTRUZIONI et al.

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 4 sheets.
 It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

- the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).
- b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing :
- contained in the international application in written form.
- filed together with the international application in computer readable form.
- furnished subsequently to this Authority in written form.
- furnished subsequently to this Authority in computer readable form.
- the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. Certain claims were found unsearchable (See Box I).

3. Unity of Invention is lacking (see Box II).

4. With regard to the title,

- the text is approved as submitted by the applicant.
- the text has been established by this Authority to read as follows:

5. With regard to the abstract,

- the text is approved as submitted by the applicant.
- the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawing to be published with the abstract is Figure No.

- as suggested by the applicant.
- because the applicant failed to suggest a figure.
- because this figure better characterizes the invention.

21

Non of the figures.

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International application No.

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Box III TEXT OF THE ABSTRACT (Continuation of Item 5 of the first sheet)

- Line 1, delete "having a New Jersey shape or a different shape, which may be used as a traffic divider or on the side of a bridge or road".
- line 9, delete "Preferably, the resistant element (A) will be made of concrete, while the dampening element (B) is made of plastics, steel or concrete".

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International Application No

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B. FIELDS SEARCHED

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EPO-Internal, PAJ

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X	BE 644 358 A (E. BUCHER) 9 July 1964 (1964-07-09)	1,2
Y	page 3, paragraph 3 -page 5, paragraph 4 page 6, paragraph 7 -page 9, paragraph 3; figures ---	3-5,10
X	---	1,11,14
Y	---	13,15,19
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		-/-

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* Special categories of cited documents :

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- *E* earlier document but published on or after the International filing date
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- *O* document referring to an oral disclosure, use, exhibition or other means
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- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

10 October 2000

Date of mailing of the International search report

17/10/2000

Name and mailing address of the ISA

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Fax: (+31-70) 340-3016

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Verveer

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 00/00248

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	column 2, line 14 - line 34; figures ---	1,10,11
A	DE 22 00 183 A (KOERTJE WERNER DR ING) 19 July 1973 (1973-07-19) the whole document ---	1,3
A	DE 74 20 685 U (H.J. SCHÖMBURG) 31 October 1974 (1974-10-31) the whole document ---	1,4
A	DE 15 34 499 A (A. GROS) 26 June 1969 (1969-06-26) the whole document ---	1,10,11, 15
A	DE 25 13 436 A (VOEST AG) 2 October 1975 (1975-10-02) page 3, paragraph 2; figures ---	5
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT 00/00248

Patent document cited in search report	Publication date	Patent family member(s)			Publication date
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		AT 160402	T		15-12-1997
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		DE 69406930	D		02-01-1998
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		EP 0710309	A		08-05-1996
		ES 2111932	T		16-03-1998
		US 5697728	A		16-12-1997
US 3844538	A 29-10-1974	NONE			
BE 644358	A 09-07-1964	DE 1459806	A		21-11-1968
		LU 45554	A		28-04-1964
		NL 6401880	A		31-08-1964
US 4681302	A 21-07-1987	EP 0297182	A		04-01-1989
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		AT 319318	B		10-12-1974
		BE 765151	A		01-10-1971
		CH 539739	A		14-09-1973
		DE 2116060	A		21-10-1971
		ES 196139	Y		01-07-1975
		NL 7104475	A,C		05-10-1971
		SE 361695	B		12-11-1973
EP 0518304	A 16-12-1992	IT 223209	Z		13-06-1995
DE 2200183	A 19-07-1973	NONE			
DE 7420685	U 31-10-1974	NONE			
DE 1534499	A 26-06-1969	NONE			
DE 2513436	A 02-10-1975	AT 330234	B		25-06-1976
		AT 258974	A		15-09-1975
		BG 28349	A		15-04-1980
		CH 587968	A		31-05-1977
		CS 198371	B		30-06-1980
		NO 751080	A,B,		30-09-1975
		SE 398250	B		12-12-1977
		SE 7503617	A		29-09-1975
JP 02157308	A 18-06-1990	JP 1905965	C		24-02-1995
		JP 6029492	B		20-04-1994

PATENT COOPERATION TREATY

PCT

REC'D 22 OCT 2001

WIPO

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference DE/EM/A3333	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/IT00/00248	International filing date (day/month/year) 15/06/2000	Priority date (day/month/year) 21/07/1999
International Patent Classification (IPC) or national classification and IPC E01F15/04		
<p>Applicant AUTOSTRADE CONCESSIONI E COSTRUZIONI et al.</p> <p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 7 sheets.</p> <p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input checked="" type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input checked="" type="checkbox"/> Certain observations on the international application 		
Date of submission of the demand 20/01/2001	Date of completion of this report 18.10.2001	
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: Fax: +49 89 2399 - 4465	<p>Authorized officer Ellis, D</p> <p>Telephone No. +49 89 2399 8159</p> 	

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/IT00/00248

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
- Description, pages:**

1,2,4-20	as originally filed		
3,3a	as received on	28/07/2001 with letter of	24/07/2001

Claims, No.:

1-19	as received on	28/07/2001 with letter of	24/07/2001
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Drawings, sheets:

1/7-7/7	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
 - the language of publication of the international application (under Rule 48.3(b)).
 - the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:
- contained in the international application in written form.
 - filed together with the international application in computer readable form.
 - furnished subsequently to this Authority in written form.
 - furnished subsequently to this Authority in computer readable form.
 - The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
 - The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.
4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/IT00/00248

- the description, pages:
- the claims, Nos.:
- the drawings, sheets:

5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)): *(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*
6. Additional observations, if necessary:

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:
 - restricted the claims.
 - paid additional fees.
 - paid additional fees under protest.
 - neither restricted nor paid additional fees.
2. This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
 - complied with.
 - not complied with for the following reasons:
4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
 - all parts.
 - the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N) Yes: Claims 1-19
 No: Claims

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/IT00/00248

Inventive step (IS) Yes: Claims 1-19
 No: Claims

Industrial applicability (IA) Yes: Claims 1-19
 No: Claims

**2. Citations and explanations
see separate sheet**

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET

International application No. PCT/IT00/00248

Re Item IV

Lack of unity of invention:

- 1 The application contains the following groups of inventions:
 - (a) independent claim 1 and dependent claims 2 to 10, and 18 and 19; and
 - (b) independent claim 11 and dependent claims 12 to 19;and thus the application lacks unity with respect to Article 3(4)(iii) PCT and Rule 13.1 PCT.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement:

- 2 Document **D3** (=US-A-4 681 302) which is considered to represent the **closest prior art** to the subject-matter of **independent claim 1** discloses
 - a) *a road safety barrier, of a symmetric kind,*
 - b) *comprising a resistant element to stop the motion of heavy vehicles,*
 - c) *including two substantially vertical walls 34,*
 - d) *and a dampening element 35, located at the foot of said resistant element, on both sides facing the carriageway;*
 - e) *said dampening element being made of a material which deforms itself upon the impact caused by an automobile.*
- 2.1 The **problem** solved by the present invention, is to modify the barrier, such that it is easier to fabricate and more effectively dissipates the kinetic energy of the impacting vehicle.
- 2.2 The **solution** to this problem is considered as involving an inventive step (Article 33(3) PCT) as there is no indication in the state of the art that would direct the skilled man to
 - f) *insert the dampening element in a seat of the resistant element (A) and/or rigidly connect it thereto, and*
 - g) *to provide said dampening element with a form which facilitates the lifting of the front part of the automobile*as proposed by the invention.
- 2.3 **Claims 2 to 10, 18 and 19** are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
- 3 Document **D10** (=US-A-5 123 773) which is considered to represent the **closest prior art** to the subject-matter of **independent claim 11** discloses
 - a) *a road safety barrier 2 of a symmetric kind,*
 - b) *comprising a continuous resistant element 20 to stop the motion of heavy vehicles,*

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EXAMINATION REPORT - SEPARATE SHEET**

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- c) *with two substantially vertical walls, and*
- d) *a continuous dampening element 16 located at the foot of said resistant element, on both sides of said resistant element facing the carriageway.*

Note: Document **D10** was not cited in the international search report. A copy of this document is attached to this IPER for the attention of the applicant.

- 3.1 The **problem** solved by the present invention, is to improve the dampening effect of the aforementioned barrier.
- 3.2 The **solution** to this problem is considered as involving an inventive step (Article 33(3) PCT) as there is no indication in the state of the art that would direct the skilled man to
 - e) *provide a dampening element made of concrete and*
 - f) *a continuous or discontinuous layer of a dampening material, or a plurality of concentrated dissipators like springs, dissipating bundles of entangled steel fibres, or the like, between the dampening element made of concrete 10, 10' and said resistant element.*as proposed by the invention.
- 3.3 **Claims 12 to 17** are dependent on claim 11 and as such also meet the requirements of the PCT with respect to novelty and inventive step.
- 4 The subject-matter disclosed by claims 1 to 19 is regarded as **industrially applicable** with regard to Article 33(4) PCT.

Re Item VII

Certain defects in the international application:

- 5 To meet the requirements of Rule 5.1(a)(ii) PCT, document **D10** should have been identified in the description and the relevant background art disclosed therein should have been briefly discussed.

Re Item VIII

Certain observations on the international application:

- 6 The term "socle" is inappropriately used in independent claim 1. According to the Collins English Dictionary, a socle is an equivalent term for a plinth. The meaning of plinth is "*the rectangular slab or block that forms the lowest part of the base of a column, statue, pedestal, or pier*". Since nowhere in the application is the dampening element B described as being underneath the resistant element A, rather it is located adjacent to the resistant element, the dampening element cannot be defined as a socle (Article 6 PCT). In

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EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/IT00/00248

examining the current application, this term (socle) has been interpreted as defining a member located adjacent to the base of the resistent element, as is understood from the description and the drawings.

- 6.1 To meet the requirements of Rule 6.3(b) PCT, the independent claims should have been properly cast in the **two part form**, with those features which in combination are part of the prior art being placed in the preamble (see document **D1 and D10**).

- 3 -

impulsive component, because otherwise both components contribute simultaneously to the amount of acceleration given by the ASI (Acceleration Severity Index), the latter being used during type approval tests for the 5 evaluation of the maximum admissible energy to which the passengers of the motorcar may be subjected, under standard extreme conditions of type tests for road barriers.

"US 4,681,302 discloses a barrier for dissipating kinetic energy upon impact by a moving vehicle. The barrier modules may be filled with water to increase their weight and they are resiliently deformable to return to their original shape after being struck.

The barrier disclosed in this document, may form a traffic divider and it captures the vehicle tire, tending to slow the tire and preventing it from climbing and the vehicle from vaulting.

This kind of barrier includes also traction spoiler channels to reduce the area of contact between the barrier and the tires of a vehicle.

While this patent US 4,681,302 already contains the idea of realising a deformable barrier, this barrier does not allow the wheel to climb, so as to convert part of the vehicle kinetic energy into potential energy. Moreover, this barrier is not resistant

- 3a -

enough to be used as a "bivalent barrier", that is a barrier stopping heavy vehicles as well as light vehicles.

Therefore, although it may be very useful in certain cases, it does not belong to the same category of barriers as those of the present invention, and consequently it does not achieve the objects of the present invention."

10 Disclosure of Invention

An object of the present invention is to shift in time the occurrence of the transversal acceleration with respect to the occurrence of the vertical acceleration, so that they will not add at the same time.

15 Another object of the invention is to further "dilute" in time the transversal component, which - as mentioned above - has an impulsive nature.

A third object of the invention is to realize barriers whose resistance may be approved during type tests and

20 be assigned, according to the embodiment in question, to any of the classes H2 to H4.

A fourth object of the invention is to provide a modular type barrier, in order to reduce to a minimum the operations to be carried out on existing infrastructures, 25 and reducing at the same time the risk of accidents during the laying, while obtaining an optimization of production costs.

A fifth object of the present invention, depending on

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Claims

1. Road safety barrier, of a symmetric or asymmetric kind, characterized in that it comprises a resistant element (A) to stop the motion of heavy vehicles, including two substantially vertical walls, and a
5 dampening element (B), forming a socle at the foot of said resistant element (A), on one side or on both sides facing the carriageway; said dampening element (B) being made of a material which deforms itself upon the impact caused by an automobile, and being inserted in a seat of
10 the resistant element (A) and/or rigidly connected to the latter, and said dampening element (B) having additionally a form which facilitates the lifting of the front part of the automobile.

- 15 2. Road safety barrier according to claim 1, wherein the at least one dampening element (B) is formed by a continuous sheet steel with open cross-section (4, 4', 4", 17) fixed on its upper part to the resistant element (A), and contacting on its lower part the substantially
20 vertical wall of the resistant element (A) or else being spaced apart from said wall.

- 25 3. Road safety barrier according to claim 1, characterized in that the dampening element (B) is formed by a continuous socle (18, 18') made of plastics, which is internally stiffened by means of a reticular

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structure, or septa (19), or a honeycomb structure, or the like.

4. Road safety barrier according to claim 1, wherein the
5 dampening element (B) is formed by a continuous socle
(13, 21, 21', 21") of plastics, which is internally
completely hollow and may be filled (21, 21', 21") with
water and an antifreeze or salt.

10 5. Road safety barrier according to claim 1,
characterized in that the dampening socle (B) is formed
by a continuous blade or strip having the shape of a
double or triple wave or the like, of a kind usually
employed for the realization of a guardrail comprising a
15 strip and posts, and wherein said strip is supported by
and connected with bolts to steel supports (15), which
are fitted at equal distances inside seats or front
recesses of the resistant element (A), the said supports
having a desired inclination in order to facilitate the
20 ascent or lifting of the front portion of the
automobile.

6. Road safety barrier according to claims 3 or 4,
characterized in that the connection with the resistant
25 element may be performed by means of a restrained joint
(6', 20), by means of continuous or discontinuous strips
(23') extending below the resistant element (A), or
above it (23"), or through (23) the resistant element

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(A), or by a combination of these systems.

7. Road safety barrier according to any of the preceding claims, wherein the resistant element (A) is anchored to its support by means of ductile screw anchors.

8. Road safety barrier according to claim 7, wherein between the resistant element (A) and its support, there are disposed friction reducing shoes.

10

9. Road safety barrier according to claim 7 or 8, wherein the reinforcement of the resistant element (A), made of concrete, has an additional bracket (37) engaging two hooks (35, 35') which are connected or welded on a lower steel-made plate (31, 31') of the resistant element (A), said plate being crossed by the ductile screw anchors (29) for the anchoring thereof to the curbstone or pavement.

20

10. Road safety barrier according to any of the preceding claims, wherein the upper part of the barrier supports a screen (24) which may be a sound dampening screen, a net for the protection against the throw of objects, a screen for the protection from gusts, and the rear part of said resistant element (A) being provided with cavities (26) for mounting sound absorbers (25).

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11. Road safety barrier of a symmetric or an asymmetric kind, characterized in that it comprises a continuous resistant element (A) extending upwards starting from the road pavement, to stop the motion of heavy vehicles, with
5 two substantially vertical walls, and a dampening element (B) which forms a continuous socle at the foot of said resistant element (A), on one or both sides of said resistant element (A) facing the carriageway; said dampening element (B) being made of concrete (10, 10') and a continuous or discontinuous
10 layer of a dampening material (11), or a plurality of concentrated dissipators (12) like springs, dissipating bundles of entangled steel fibers, or the like, being introduced between the dampening element (B) made of concrete (10, 10') and said resistant element (A).
15
12. Road safety barrier according to claim 11, wherein the dampening material (11) is polystyrene.
13. Road safety barrier according to claim 11. wherein
20 the dampening element made of concrete (10') is simply laid on the curbstone or pavement, without being connected to the resistant element (A).
14. Road safety barrier according to claim 11, wherein
25 the dampening element (10) is connected to the resistant element (A), for example by means of bolts, which however permit the translation of the dampening element

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longitudinal extension of the barrier.

15. Road safety barrier according to any of the claims 11 to 14, wherein the resistant element (A) supports a screen (3, 24) or a handrail (1, 2).

16. Road safety barrier according to claim 11, wherein said resistant element (A) is anchored to the curbstone or pavement by means of ductile anchor means (29).

10

17. Road safety barrier according to claims 11 and 16, wherein friction reducing shoes are disposed below the dampening element (B).

15 18. Road safety barrier according to claim 1 or 11, wherein the barrier formed by the resistant element (A) and the dampening element (B), has an overall shape which substantially corresponds to the shape of a New Jersey barrier.

20

19. Road safety barrier according to claim 1 or 11, wherein the resistant element (A) is provided with rear cavities (26) for the insertion of noise absorbers (25) of a known kind, which serve to selectively absorb 25 medium/low frequencies.

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impulsive component, because otherwise both components contribute simultaneously to the amount of acceleration given by the ASI (Acceleration Severity Index), the latter being used during type approval tests for the 5 evaluation of the maximum admissible energy to which the passengers of the motorcar may be subjected, under standard extreme conditions of type tests for road barriers.

10 Disclosure of Invention

An object of the present invention is to shift in time the occurrence of the transversal acceleration with respect to the occurrence of the vertical acceleration, so that they will not add at the same time.

15 Another object of the invention is to further "dilute" in time the transversal component, which - as mentioned above - has an impulsive nature.

A third object of the invention is to realize barriers whose resistance may be approved during type tests and 20 be assigned, according to the embodiment in question, to any of the classes H2 to H4.

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A fifth object of the present invention, depending on

Claims

1. Road safety barrier, of a symmetric or asymmetric kind, characterized in that it comprises a resistant element (A) to stop the motion of heavy vehicles, including two substantially vertical walls, and a
5 dampening element (B), forming a socle at the foot of said resistant element (A), on one side or on both sides facing the carriageway; said dampening element (B) being made of a material which deforms itself upon the impact caused by an automobile, and being inserted in a seat of
10 the resistant element (A) and/or rigidly connected to the latter, and said dampening element (B) having additionally a form which facilitates the lifting of the front part of the automobile.
- 15 2. Road safety barrier according to claim 1, wherein the at least one dampening element (B) is formed by a continuous sheet steel with open cross-section (4, 4', 4", 17) fixed on its upper part to the resistant element (A), and contacting on its lower part the substantially
20 vertical wall of the resistant element (A) or else being spaced apart from said wall.
- 25 3. Road safety barrier according to claim 1, characterized in that the dampening element (B) is formed by a continuous socle (18, 18') made of plastics, which is internally stiffened by means of a reticular

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structure, or septa (19), or a honeycomb structure, or the like.

4. Road safety barrier according to claim 1, wherein the
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10 5. Road safety barrier according to claim 1,
characterized in that the dampening socle (B) is formed
by a continuous blade or strip having the shape of a
double or triple wave or the like, of a kind usually
employed for the realization of a guardrail comprising a
15 strip and posts, and wherein said strip is supported by
and connected with bolts to steel supports (15), which
are fitted at equal distances inside seats or front
recesses of the resistant element (A), the said supports
having a desired inclination in order to facilitate the
20 ascent or lifting of the front portion of the
automobile.

6. Road safety barrier according to claims 3 or 4,
characterized in that the connection with the resistant
25 element may be performed by means of a restrained joint
(6', 20), by means of continuous or discontinuous strips
(23') extending below the resistant element (A), or
above it (23"), or through (23) the resistant element

- 23 -

(A), or by a combination of these systems.

7. Road safety barrier according to any of the preceding claims, wherein the resistant element (A) is anchored to its support by means of ductile screw anchors.

8. Road safety barrier according to claim 7, wherein between the resistant element (A) and its support, there are disposed friction reducing shoes.

10

9. Road safety barrier according to claim 7 or 8, wherein the reinforcement of the resistant element (A), made of concrete, has an additional bracket (37) engaging two hooks (35, 35') which are connected or welded on a lower steel-made plate (31, 31') of the resistant element (A), said plate being crossed by the ductile screw anchors (29) for the anchoring thereof to the curbstone or pavement.

20

10. Road safety barrier according to any of the preceding claims, wherein the upper part of the barrier supports a screen (24) which may be a sound dampening screen, a net for the protection against the throw of objects, a screen for the protection from gusts, and the rear part of said resistant element (A) being provided with cavities (26) for mounting sound absorbers (25).

- 24 -

11. Road safety barrier of a symmetric or an asymmetric kind, characterized in that it comprises a resistant element (A) to stop the motion of heavy vehicles, with two substantially vertical walls, and a dampening element (B) which forms a socle at the foot of said resistant element (A), on one or both sides of said resistant element (A) facing the carriageway; said dampening element (B) being made of concrete (10, 10') and a continuous or discontinuous layer of a dampening material (11), or a plurality of concentrated dissipators (12) like springs, dissipating bundles of entangled steel fibers, or the like, being introduced between the dampening element (B) made of concrete (10, 10') and said resistant element (A).

15

12. Road safety barrier according to claim 11, wherein the dampening material (11) is polystyrene.

20 13. Road safety barrier according to claim 11, wherein the dampening element made of concrete (10') is simply laid on the curbstone or pavement, without being connected to the resistant element (A).

25 14. Road safety barrier according to claim 11, wherein the dampening element (10) is connected to the resistant element (A), for example by means of bolts, which however permit the translation of the dampening element (10) upon impact, in a direction perpendicular to the

- 25 -

longitudinal extension of the barrier.

15. Road safety barrier according to any of the claims
11 to 14, wherein the resistant element (A) supports a
5 screen (3, 24) or a handrail (1, 2).

16. Road safety barrier according to claim 11, wherein
said resistant element (A) is anchored to the curbstone
or pavement by means of ductile anchor means (29).

10

17. Road safety barrier according to claims 11 and 16,
wherein slide shoes are disposed below the dampening
element (B).

15 18. Road safety barrier according to claim 1 or 11,
wherein the barrier formed by the resistant element (A)
and the dampening element (B), has an overall shape
which substantially corresponds to the shape of a New
Jersey barrier.

20

19. Road safety barrier according to claim 1 or 11,
wherein the resistant element (A) is provided with rear
cavities (26) for the insertion of noise absorbers (25)
of a known kind, which serve to selectively absorb
25 medium/low frequencies.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/06063 A1

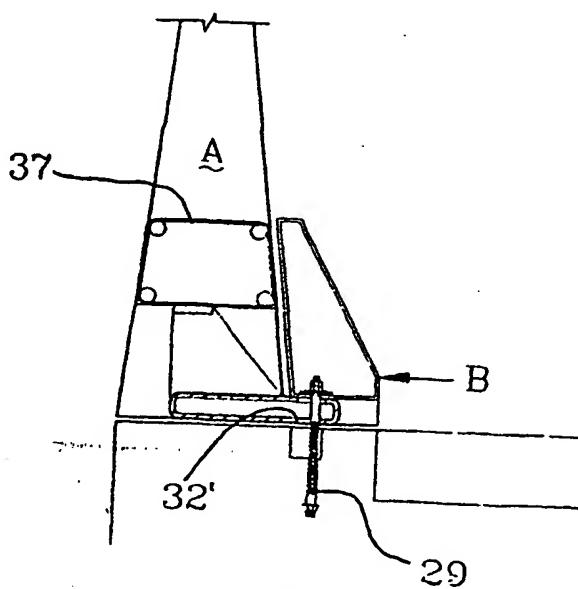
- (51) International Patent Classification⁷: **E01F 15/04**
- (21) International Application Number: **PCT/IT00/00248**
- (22) International Filing Date: **15 June 2000 (15.06.2000)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data:
RM99A000464 21 July 1999 (21.07.1999) **IT**
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- (74) Agents: **DOMENIGHETTI FIAMMENGHI, Delfina et al.; Fiammenghi Fiammenghi, Via Quattro Fontane 31, I-00184 Roma (IT).**
- (81) Designated States (national): **AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.**
- (84) Designated States (regional): **ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).**

Published:

— With international search report.

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(54) Title: **A MULTIPURPOSE ROAD BARRIER, HAVING A DOUBLE DAMPENING-RESISTANT EFFECT**



(57) Abstract: Road safety barrier of a "movable wall" type, the barrier having a double effect or function in order to stop both light vehicles and heavy goods vehicles, and comprising a resistant element (A) and one or two dampening elements (B) for a lateral barrier or a traffic divider respectively. The resistant element of the wall type barrier may be rigidly connected to steel plates which are equally spaced and have been specifically conceived for increasing the resistance during an impact caused by a heavy vehicle; said plates have a slot for the passage of ductile screw anchors, allowing the initial displacement of the resistant element and its connection to the support. If provided, the ductile anchor means are covered by the dampening element (B).

WO 01/06063 A1

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 00/00248

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E01F15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, PAJ

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Y	—	13,15,19
A	—	2,8,17
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

& document member of the same patent family

Date of the actual completion of the international search

10 October 2000

Date of mailing of the international search report

17/10/2000

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 00/00248

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International Application No

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
25 January 2001 (25.01.2001)

PCT

(10) International Publication Number
WO 01/06063 A1

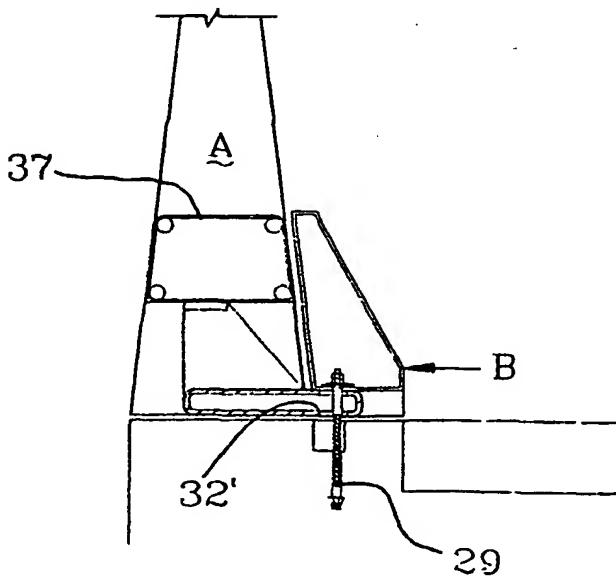
- (51) International Patent Classification⁷: **E01F 15/04** (74) Agents: **DOMENIGHETTI FLAMMENGHINI**, Delfina et al.; Fiammenghi Fiammenghi, Via Quattro Fontane 31, I-00184 Roma (IT).
- (21) International Application Number: **PCT/IT00/00248** (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (22) International Filing Date: 15 June 2000 (15.06.2000) (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (25) Filing Language: English (30) Priority Data: RM99A000464 21 July 1999 (21.07.1999) IT
- (26) Publication Language: English
- (71) Applicant (for all designated States except US): AUTOSTRADE CONCESSIONI E COSTRUZIONI [IT/IT]; Autostrade S.p.A., Via A. Bergamini, 50, I-00159 Roma (IT).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): **CAMOMILLA, Gabriele** [IT/IT]; Via A. Bergamini, 50, I-00159 Roma (IT). **BRUSCHI, Stefano** [IT/IT]; Via A. Bergamini 50, I-00159 Roma (IT).

Published:

— With international search report.

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(57) Abstract: Road safety barrier of a "movable wall" type, the barrier having a double effect or function in order to stop both light vehicles and heavy goods vehicles, and comprising a resistant element (A) and one or two dampening elements (B) for a lateral barrier or a traffic divider respectively. The resistant element of the wall type barrier may be rigidly connected to steel plates which are equally spaced and have been specifically conceived for increasing the resistance during an impact caused by a heavy vehicle; said plates have a slot for the passage of ductile screw anchors, allowing the initial displacement of the resistant element and its connection to the support. If provided, the ductile anchor means are covered by the dampening element (B).

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Description

A multipurpose road barrier, having a double dampening-resistant effect

Technical Field

The present invention relates to a multipurpose road safety barrier, that is, to a barrier adaptable for being used on the side of a bridge, or as lateral barrier, or as a traffic divider, and which can also be utilized (provided it is appropriately modified) as a support for a sound proofing screen or a screen for protection against the throw of objects. The barrier may be subjected to type approval in various classes corresponding to different resistances, up to the one corresponding to the maximum resistance (H4).

The barrier allows to dampen the collision, by way of a controlled deceleration, in case of light motorcars, while stopping the motion of heavy vehicles.

15

Background Art

Road barriers of the wall kind and having a New Jersey (NJ) profile, which are made of monolithic blocks of concrete and which, after their assembling, give rise to a high quality protection, are already known in the art. In those barriers the calibration of the deceleration is obtained, in case of motorcars and generally of light vehicles, by means of the lifting of the vehicle due to

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the New Jersey shape, and at the same time, due to the presence of sliding shoes, if any, which facilitate the displacement of the barrier and which are interposed between the barrier and its support. Therefore, if the
5 impact angle is restricted, the motorcar is again deviated towards the carriageway, whereas, if it is noticeable, the sliding shoes will promote the displacement of the barrier and calibrate the deceleration values, as mentioned above.

10 The barriers of the wall type, even if provided with slide facilitating devices (shoes) acting during part of the maximum allowable displacement, as disclosed in some patent applications of the same applicant, and even if provided with a projecting socle (base) having a New
15 Jersey profile or a different configuration, always give rise to a deceleration caused by the collision, and to relevant components of the same in the longitudinal, transversal, and vertical direction with respect to the direction of motion.

20 In particular, the vertical component is very strong for those types of barriers, and also the transversal component is usually of an impulsive nature (the longitudinal component is more distributed in time). The first of these components has a beneficial effect on the
25 dissipation of kinetic energy of motorcars, since it converts the same into potential energy (lifting), which will be returned after some time, but its generation must not occur simultaneously to that of the transversal

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impulsive component, because otherwise both components contribute simultaneously to the amount of acceleration given by the ASI (Acceleration Severity Index), the latter being used during type approval tests for the 5 evaluation of the maximum admissible energy to which the passengers of the motorcar may be subjected, under standard extreme conditions of type tests for road barriers.

10 Disclosure of Invention

An object of the present invention is to shift in time the occurrence of the transversal acceleration with respect to the occurrence of the vertical acceleration, so that they will not add at the same time.

15 Another object of the invention is to further "dilute" in time the transversal component, which - as mentioned above - has an impulsive nature.

A third object of the invention is to realize barriers whose resistance may be approved during type tests and 20 be assigned, according to the embodiment in question, to any of the classes H2 to H4.

A fourth object of the invention is to provide a modular type barrier, in order to reduce to a minimum the operations to be carried out on existing infrastructures, 25 and reducing at the same time the risk of accidents during the laying, while obtaining an optimization of production costs.

A fifth object of the present invention, depending on

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the preceding one, is to realize a barrier made of monolithic blocks and modules which can be directly connected to one another with a minimum laying time and are adaptable to any kind of road structure.

5 A further object is to include in the barrier typology of the present invention, all particular constructive means which are already used in this technical field, like longitudinal connection bars between modules, which are made of special materials with a controlled ductility, or ductile screw anchors having a predetermined resistance to breakage, and possibly friction reducing shoes, thereby increasing the system reliability.

According to the invention, the innovative barrier 15 obtains the dampening of the collision caused by a light vehicle, in a more effective way with respect to the known art, by dividing up the "small wall" formed by a traditional barrier, into two elements, a resistant one (hereinafter called element A) and a dampening one 20 (hereinafter called element B).

It should be noted that the dampening element B always faces the carriageway, and is located in front of the resistant element A.

A symmetric single-row traffic divider will then be 25 formed by two elements B located on both sides of the central resistant element A.

In case of a barrier used for the side of a bridge or of a lateral barrier, which is asymmetric, there will be

- 5 -

only a single dampening element B and a rear resistant element A.

The element B is located at the foot of the element A, so as to form a monolithic socle extending along the 5 whole length of the element A (which is itself monolithic).

The element A serves for stopping -in case of low energy impacts-the displacement of the other (front) element B, whose purpose is instead to receive and absorb a first

10 part of the impact energy of a goods vehicle or the whole amount of impact energy of a light motorcar; the dampening of this energy will occur according to multiple processes described later on, related to the deformability of the element B, and/or to the

15 interposition of dissipating material between the two elements A and B, and/or to the kind of connection of the front element B with respect to the support, by means of calibrated friction (shoes), or to the connection with the second resistant element A, through

20 anchor means and/or mutually fitted parts (restricted joints).

The barrier, depending on its use, will be:

- symmetric, that is with two dampening elements on both sides of the resistant element;

25 - asymmetric, that is with a single dampener on the side of the possible impact.

The form of the dampening element B corresponds in general to the shape of a socle, which complements the

- 6 -

shape of the rear element A, so that, in case one intends to realize an NJ barrier, the barrier (A plus B) will assume the shape of a traditional New Jersey barrier. In general, the socle may have a shape

5 different from that of an NJ profile, e.g. the shape may be rounded, elliptical, etc., provided it is suited for the intended purposes. The overall profile of the barrier will be defined by the profile of both elements A and B.

10 By the introduction of a deformable element at the "wall" base, it is possible to obtain the following:
- a dilution in time of the transversal component, which will have a more gradual peak increase;
- a postponement of the time the vehicle starts climbing
15 on the socle B, because the latter deforms itself before allowing the vehicle to ascend, thereby giving rise to a noticeable (or maximum) value of vertical acceleration a fraction of a second later than the increase of the first (transversal) component.

20 The use of appropriate anchor means, together with the resistant element A, of an (energy) dissipating material -if any- interposed between the elements A and B, and of the deformable material making up the socle B, will serve for the purpose of a better calibration of the
25 described operation.

This aspect of the invention relates to the control (calibration) of light impacts; for what concerns higher energy impacts, up to the maximum energy contemplated by

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the rules on type approval, the resistance will be provided by the resistant element, whose height, transversal dimension, and specific weight, may be arbitrarily chosen, depending on the function of the

5 barrier (safety and screen function, or only safety).

The resistant element A can be made of concrete, including an internal reinforcement, or by other materials, e.g. steel of suitable sheet thickness, whereas the dampening element may be made of plastics, 10 steel, or possibly of concrete, but in the latter case an energy dissipating material will be interposed between elements A and B.

In case the socle B is manufactured using plastics, it is possible to employ a reticular, honeycomb, or hollow 15 structure, or a structure filled with water and an antifreeze.

Brief Description of Drawings

The present invention will now be described in more 20 detail by means of some examples of certain specific embodiments thereof, given by way of example only, and not for limiting purposes, said embodiments being shown in the annexed drawings, in which:

25 Fig. 1a schematically shows a cross section of an asymmetric, double effect, New Jersey type barrier, according to the present invention, comprising a resistant and a dampening element;

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Fig. 1b schematically shows a cross section of a symmetric double effect and single-row type barrier (traffic divider), according to the present invention, including two elements B;

5

Fig. 2a is a cross section of a possible embodiment of an anchored asymmetric barrier, according to the invention, acting as a guard (parapet);

10 Fig. 2b is a cross section of an embodiment of an asymmetric barrier anchored to the curbstone, acting as a guard and screen;

15 Figs. 3 to 6 show different embodiments of a steel-made socle or dampening element B;

Figs. 7 and 8 show different embodiments of a socle B made of concrete;

20 Fig. 9 is a cross section of an embodiment of socle B of the barrier, the socle being made of plastics;

25 Fig. 10 is a cross section of a barrier with its socle B, the latter being formed by a triple wave connected by bolts to a plurality of trapezoidal sheet metal supports;

Fig. 11 is a perspective view of a sheet metal support

- 9 -

used to support the triple wave;

Fig. 12 is an embodiment analogous to that of Fig. 10,
but including a shaped substantially trapezoidal sheet
5 steel, forming a single draw piece (section);

Fig. 13 is a barrier comprising a plastic made socle
with longitudinal septa (separation walls);

10 Fig. 14 is a barrier having a plastic made socle with
longitudinal septa and restricted joint type connection;

15 Fig. 15 is a barrier including a hollow type plastic
made socle, filled with a mixture of water and sodium
chloride;

20 Fig. 16 is a front view of fig. 15, omitting in the
latter the socle B, and showing the holes for the
introduction of the coupling means for securing the
socle B to the element A, wherein the holes are obtained
on element A;

25 Fig. 17 is a second embodiment of a plastic made socle,
filled with water and an antifreeze or salt, whose
movements are restrained by the very weight of element
A;

Fig. 18 is a third embodiment, including a plastic made

- 10 -

socle B filled with water and an antifreeze, fixed to element A by means of a continuous strip of material which surrounds or hooks from above the upper part of element A;

5

Fig. 19 is a cross section of a double effect barrier according to the invention, provided with a screen, noise absorbers, and anchor means in the form of ductile screw anchors, for the resistant element A; and

10

Figs. 20, 21, 22 are perspective and cross sectional views of two specific anchor systems, which are embedded inside the material making up the resistant element A, and which provide for a movable and ductile anchor system relative to the support, by means of special screw anchors.

Modes for Carrying out the Invention

Figs. 1a and 1b are schematic views of barrier typologies, showing how the barrier of the invention 20 comprises a resistant element A and a dampening element B (in case of an asymmetric barrier for the side of a bridge or of a lateral barrier), or respectively, two dampening elements B (in case of a symmetric single-row type traffic divider). Obviously, the constructive 25 details will be explained in the following description, with reference to the corresponding figures. Moreover, it should be clear that the socle B, while having a

- 11 -

shape of a New Jersey socle in Figs. 1a and 1b, will have -as may be seen also in the following Figs.- a different shape according to particular requirements and to the desired ASI value of the impact deceleration.

5 Figs. 2a and 2b show how the resistant element may be anchored to the curbstone using means known in the art (ductile screw anchors with a predetermined threshold of breakage), and as illustrated in more detail in the description of Figs. 20, 21, 22. Should the dampening or
10 absorbing effect produced by the elements B be insufficient, no limitations would exist to the addition of friction reducing shoes, which are already known from some patent applications of the same applicant, filed before the present one.

15 Said friction reducing shoes will be disposed below the socle B or below the resistant element A (see Fig. 20 and the related description for the latter case). The shoes could -possibly- be used in case of a concrete made socle, in the embodiment interposing dampening elements between the two elements A, B, in order to reduce friction between the socle and its supporting surface.

20 In Figs. 2a and 2b the number 1 denotes the handrail support of the handrail 2, whereas the number 3 denotes a screen supported by the element A, which has appropriate dimensions. The screen may be a protection net against the throw of objects, a windscreens, a sound-proof screen, etc.

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Following the natural order of the Figures, Fig. 3 suggests a solution in which the socle B is formed by a steel-made element with an open cross section 4, connected by bolts to bushes embedded in the concrete of the resistant element A. On its lower side, the steel-made element 4 is simply laid on the curbstone or road pavement, so as to promote the displacement and the deformation in the eventuality of a collision.

Fig. 4 shows the position of the bushes 5 (front view of the resistant element A taken alone, before assembling element B).

Fig. 5 shows a solution according to which, on its upper part, the steel-made and open-cross section element 4' is simply fitted, along separate portions, inside a discontinuous groove of steel, the latter being obtained by means of prefabricated pieces 6, which are embedded inside the concrete of the element A. The pieces 6 may be provided with hooks 7 for anchoring them to the concrete material of element A.

While in Fig. 3, the lower part of the steel-made element 4 - having an open cross section - was not in contact with the the vertical wall 8 of the resistant element A, according to Fig. 6, the steel-made element 4" has a contact portion 9 with the vertical wall 8, and therefore will not give rise to a displacement or only to a very little displacement as compared with the element shown in Fig. 3, upon impact by a vehicle.

The embodiment of Fig. 7 shows on the other hand a socle

- 13 -

B which is made of a concrete element 10 connected to A by means of bolts. In this case, the socle B is obviously not capable of deforming itself, and the dampening effect is provided by a dampening material 11, 5 which may be polystyrene of a particularly specified density or another material with similar features. It goes without saying that the socle B must extend itself along the whole length of the relative module of the barrier (e.g. 6 meters), and the same holds, in the 10 present embodiment, for the filling of the dampening material 11, even if a situation should not be excluded in which the latter is discontinuous to a sufficient amount for a better calibration of the decelerations. On the contrary, the dampening element of concrete 10', 15 shown in Fig. 8, is connected with A by a dissipating means which is concentrated in certain points of element A, wherein the distance between said concentrated dissipating means 12 inserted in opposed cavities of A and B may be modulated according to the length of the 20 barrier modules.

Examples of concentrated dissipating means are: helical steel-made springs, bundles or "packages" of entangled steel fibers as used on a different scale for earthquake-proof supports (not shown), etc.

25 A further class of dampening elements B is that of plastic made elements. In Fig. 9 there is shown an example of a socle B made of plastics, denoted by numeral 13, formed by a continuous trapezoidal element,

- 14 -

inserted in the recess 14 of A. The impact is in this case damped by the deformation of the element 13.

In Fig. 10 there is shown a concrete made barrier having a socle B formed by a triple wave (of a kind usually

5 employed for guardrails comprising posts and strips) which is connected by bolts to a plurality of supports of the type shown in Fig. 11. The trapezoidal supports (having an open shape) made of steel 15 may for instance be fitted every two meters in the recess 14' of the
10 concrete made element A. The trapezoidal supports 15 will have an appropriate slope which facilitates the climbing or ascent of the automobile hitting the blade (strip). Obviously, a strip formed by a double wave or of another kind may also be used.

15 This solution which utilizes the strips or blades usually employed for the guardrails including posts and strips, has the advantage of recycling materials which are already used.

The deformation of the blade or strip has the effect of
20 diluting in time the transversal component, and allows at the same time the ascent of the vehicle. An obvious possible variant is that making use of a blade mounted vertically with respect to element A (not shown in the drawings).

25 Fig. 12 shows an arrangement including a socle made of steel having an open cross section, which has a special shape on the surface of impact, so as to be provided with stiffening ribs 17 obtained by drawing.

- 15 -

Fig. 13 shows a solution wherein the socle 18 is formed by a plastic made dissipator with longitudinal dividing septa (walls) 19. The socle 18 may be formed by using rotational moulding of polyethylene or pulltrusion of polyester or another plastic material, which is then connected to spaced apart strips of fibers, disposed at distances of 1 or 2 meters from each other, and passing through a slit of the concrete made element A.

Fig. 14 shows a socle which is identical to that shown in Fig. 13, but employing a restrained joint (obtained by a pressure action), including a bulb shaped part which is introduced inside an element analogous to the element 6 of Fig. 5. The bulb-shaped part 20 may be continuous or not.

It is obvious that the longitudinal septa 19 may be replaced by a different structure (a reticular or a honeycomb structure, etc.).

An energy dissipator made of plastics, and without inner septa, filled with water and an antifreeze or salt, to prevent ice formation, in case of impact during the winter, is illustrated in Figs. 15, 17, 18, and is indicated by the numerals 21, 21', 21" respectively. So as to prevent the immediate compression of the water, the socle 21, 21' or 21" may be filled only partially with water and antifreeze or salt.

Figs. 15, 17 and 18 differ from each other only with regard to the connection with the resistant element A. In Fig. 15 the connection is made by inserting

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respective strips 23, e.g. of sheet steel, in the holes 22 of Fig. 16, and fixing in an appropriate way the strips 23 on the rear side of element A.

In Fig. 17 the strip 23', which may be continuous or 5 point-like, welded (if of the same material) or connected to element 21', is disposed below A, which prevents its movement by its own weight. In Fig. 18 the connection strip passes over element A, and may comprise 10 cat's eyes, if any. In case the strip is continuous, a protection of the concrete material from chemically aggressive agents which are present on roads is obtained at the same time.

It is obvious that possible combinations or variants of 15 all embodiments of the socle which have been illustrated above, should not be excluded, with respect to features like the inner structure, the type of connection with element A, the use of slide shoes in case of a socle made of concrete, etc.

The calibration of the decelerations may therefore be 20 obtained by varying the socle mass, or the type of connection with A, or else by providing a possibility of free displacement of the lower part of the socle (see Figs. 3 and 5), etc.

Fig. 19 shows a variant of the barrier, for use as a 25 screen support.

The screen 24 (e.g. a net for the protection against the throw of objects, a screen for sound insulation, or a windscreens) is mounted on the upper part of A, and has a

- 17 -

known linear weight given in kg/m. Sound absorbers 25 (with a known linear weight) are arranged on the rear part of A, inside recesses 26. The element A is anchored to the curbstone, e.g. by means of ductile screw anchors 5 29 passing through the steel plate 30, the latter forming a single body or piece with the concrete of A. Steel made connection means 28, provided on plate 30, and embedded during the casting of the concrete, ensure a reliable connection between the plate and the concrete 10 of A. Anchor means which are more resistant and/or easier to realize, will be described later with reference to Figs. 20-22.

Bolts 27 are used as rear anchor means against the force of the wind, and have a reduced resistance to shearing 15 in order to allow the displacements following the impact. The screw anchors 29 on the opposite side have the same function too; moreover, they deform themselves in a controlled manner and have a predetermined resistance to breakage.

20 The resistant element A has - in the embodiment of Fig. 19 - a large sized structure, and can support both the whole mass of the upper screen 24 and the above mentioned noise absorbers 25, which selectively absorb medium/low frequency noise. A crash test for type 25 approval performed only having regard to the safety aspect, could be carried out with the sound absorbing parts simply simulated with respect to their mass and position; this allows to use barriers which, for what

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concerns those parts, are different from the point of view of their function as an acoustic insulation screen, but are identical with respect to their safety function. Figs. 20, 21, 22 show the details of other two types of connection means between the resistant element A and the curbstone or pavement, said means being embedded in the casting.

A U-shaped sheet steel 31 presents a slot 32 for the insertion of the screw anchor 29. Through the slits 34 of the U-shaped part, there passes a bracket 38 which is also U-shaped and which has two arms terminating in two hook portions 35, the latter engaging further brackets 37 and 37', embedded as reinforcements in the concrete of A whose boundary is denoted by dotted lines 33. The reinforced-concrete rods 36, 36' of the conventional reinforcement pass above the sheet metal 31. The disclosed connection realizes a chain of connections between the components 31 and 38 on the one hand, and, on the other, between 37, 37'.

The described connection system has the advantage that it does not require welded parts.

The number 33 denotes the boundary of the region occupied by the concrete of A.

The front portion 39 (which is located on the back side in the Fig.) of the sheet metal 31, projects beyond the foot of the concrete element A.

Figs. 21 and 22 show another kind of connection, having the same function, but comprising welded parts.

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In this case the plate is formed by a box-like element 31', and the hook portions 35" which engage the additional brackets 37 and 37', are welded on the upper surface of the box-like element 31'. The components 31', 5 35' are embedded in the concrete of A. A slot 32' is formed both on the upper and the lower part of element 31' (see Fig. 21) and serves for the passage of the ductile screw anchor. The dotted line around the slot 32' denotes the washer for the abutting head (nut) of 10 the screw anchor.

Turning again our attention to Fig. 20, a slide shoe for reducing friction with the curbstone or pavement, may be provided below the U-shaped raised part 31.

It is possible that the resistant element A will, in 15 some cases, not include slide shoes or ductile anchor means for the connection to the support.

Industrial Applicability

As has been already pointed out, the barrier may vary 20 between classes of smaller resistance (H2) and those of maximum resistance (H4). According to Italian regulations, this means that the impact energy the barrier - according to its different embodiments - must be able to withstand, varies from 128 Kj for the H2 25 class, to 572 Kj or 724 Kj for the H4 class, depending on the vehicle type.

Moreover the barrier must prevent lorries from vaulting, wherein said lorries have a maximum height for their

- 20 -

center of gravity which must not exceed about 1,60 meters. This means that the barrier must have excellent features in order to prevent vaulting and thereby to avoid very serious consequences not only to the 5 passengers of the colliding vehicle, but also to possible railways, roads, buildings, etc. located below a bridge etc.

At the same time, the barrier must deform itself and be able to move backwards, so as to absorb the impact 10 energy in a controlled manner.

Taking into account the fact that usually a large space is not available, the transversal movement of the barrier, which is in any case desirable, must always be restricted.

15 The measured components of the accelerations, must give rise to an ASI

$$\text{ASI} = [(a_x/12)^2 + (a_y/8)^2 + (a_z/10)^2]^{1/2}$$

- less or equal to one for normal use;
- less or equal to 1.4 for the use on particularly

20 dangerous bridges, e.g. barriers to be installed on the bridge side.

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Claims

1. Road safety barrier, of a symmetric or asymmetric kind, characterized in that it comprises a resistant element (A) to stop the motion of heavy vehicles, including two substantially vertical walls, and a
5 dampening element (B), forming a socle at the foot of said resistant element (A), on one side or on both sides facing the carriageway; said dampening element (B) being made of a material which deforms itself upon the impact caused by an automobile, and being inserted in a seat of
10 the resistant element (A) and/or rigidly connected to the latter, and said dampening element (B) having additionally a form which facilitates the lifting of the front part of the automobile.

- 15 2. Road safety barrier according to claim 1, wherein the at least one dampening element (B) is formed by a continuous sheet steel with open cross-section (4, 4', 4", 17) fixed on its upper part to the resistant element (A), and contacting on its lower part the substantially vertical wall of the resistant element (A) or else being
20 spaced apart from said wall.

- 25 3. Road safety barrier according to claim 1, characterized in that the dampening element (B) is formed by a continuous socle (18, 18') made of plastics, which is internally stiffened by means of a reticular

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structure, or septa (19), or a honeycomb structure, or the like.

4. Road safety barrier according to claim 1, wherein the
5 dampening element (B) is formed by a continuous socle
(13, 21, 21', 21") of plastics, which is internally
completely hollow and may be filled (21, 21', 21") with
water and an antifreeze or salt.

10 5. Road safety barrier according to claim 1,
characterized in that the dampening socle (B) is formed
by a continuous blade or strip having the shape of a
double or triple wave or the like, of a kind usually
employed for the realization of a guardrail comprising a
15 strip and posts, and wherein said strip is supported by
and connected with bolts to steel supports (15), which
are fitted at equal distances inside seats or front
recesses of the resistant element (A), the said supports
having a desired inclination in order to facilitate the
20 ascent or lifting of the front portion of the
automobile.

25 6. Road safety barrier according to claims 3 or 4,
characterized in that the connection with the resistant
element may be performed by means of a restrained joint
(6', 20), by means of continuous or discontinuous strips
(23') extending below the resistant element (A), or
above it (23"), or through (23) the resistant element

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(A), or by a combination of these systems.

7. Road safety barrier according to any of the preceding claims, wherein the resistant element (A) is anchored to its support by means of ductile screw anchors.

5 8. Road safety barrier according to claim 7, wherein between the resistant element (A) and its support, there are disposed friction reducing shoes.

10

9. Road safety barrier according to claim 7 or 8, wherein the reinforcement of the resistant element (A), made of concrete, has an additional bracket (37) engaging two hooks (35, 35') which are connected or 15 welded on a lower steel-made plate (31, 31') of the resistant element (A), said plate being crossed by the ductile screw anchors (29) for the anchoring thereof to the curbstone or pavement.

20

10. Road safety barrier according to any of the preceding claims, wherein the upper part of the barrier supports a screen (24) which may be a sound dampening screen, a net for the protection against the throw of objects, a screen for the protection from gusts, and 25 the rear part of said resistant element (A) being provided with cavities (26) for mounting sound absorbers (25).

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11. Road safety barrier of a symmetric or an asymmetric kind, characterized in that it comprises a resistant element (A) to stop the motion of heavy vehicles, with two substantially vertical walls, and a dampening element (B) which forms a socle at the foot of said resistant element (A), on one or both sides of said resistant element (A) facing the carriageway; said dampening element (B) being made of concrete (10, 10') and a continuous or discontinuous layer of a dampening material (11), or a plurality of concentrated dissipators (12) like springs, dissipating bundles of entangled steel fibers, or the like, being introduced between the dampening element (B) made of concrete (10, 10') and said resistant element (A).

15

12. Road safety barrier according to claim 11, wherein the dampening material (11) is polystyrene.

13. Road safety barrier according to claim 11. wherein the dampening element made of concrete (10') is simply laid on the curbstone or pavement, without being connected to the resistant element (A).

14. Road safety barrier according to claim 11, wherein the dampening element (10) is connected to the resistant element (A), for example by means of bolts, which however permit the translation of the dampening element (10) upon impact, in a direction perpendicular to the

- 25 -

longitudinal extension of the barrier.

15. Road safety barrier according to any of the claims
11 to 14, wherein the resistant element (A) supports a
5 screen (3, 24) or a handrail (1, 2).

16. Road safety barrier according to claim 11, wherein
said resistant element (A) is anchored to the curbstone
or pavement by means of ductile anchor means (29).

10

17. Road safety barrier according to claims 11 and 16,
wherein slide shoes are disposed below the dampening
element (B).

15

18. Road safety barrier according to claim 1 or 11,
wherein the barrier formed by the resistant element (A)
and the dampening element (B), has an overall shape
which substantially corresponds to the shape of a New
Jersey barrier.

20

19. Road safety barrier according to claim 1 or 11,
wherein the resistant element (A) is provided with rear
cavities (26) for the insertion of noise absorbers (25)
of a known kind, which serve to selectively absorb
25 medium/low frequencies.

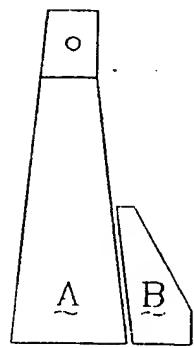


FIG. 1a

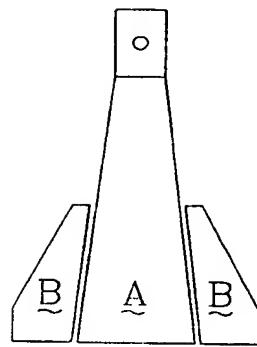


FIG. 1b

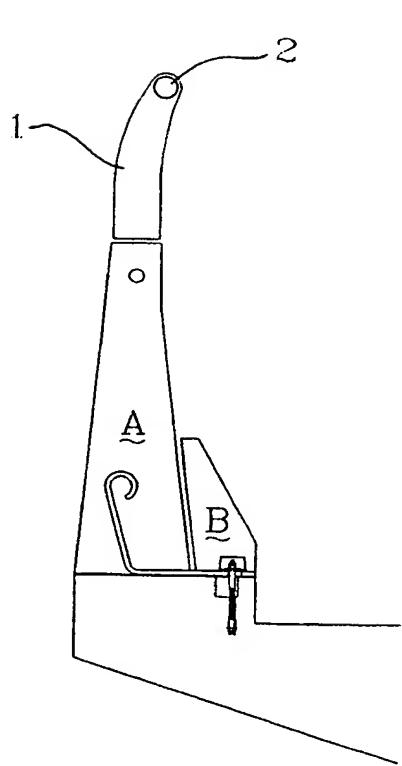


FIG. 2a

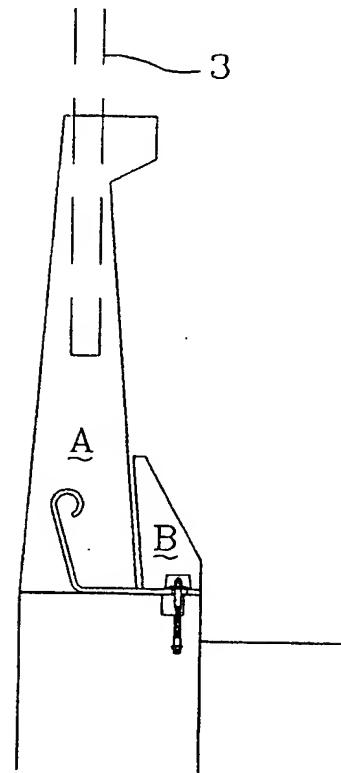


FIG. 2b

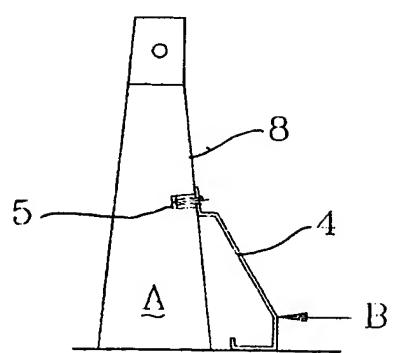


FIG. 3

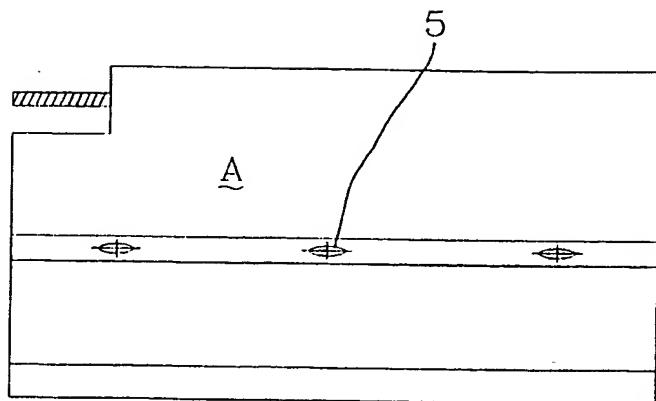


FIG. 4

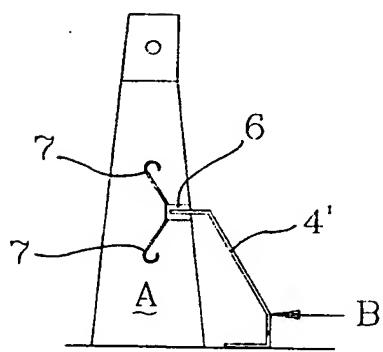


FIG. 5

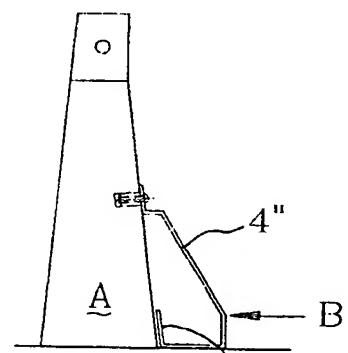


FIG. 6

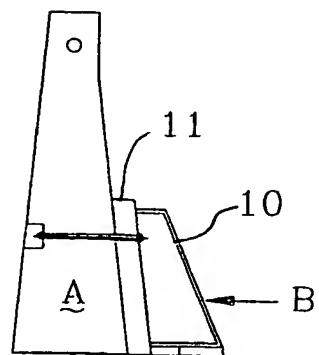


FIG. 7

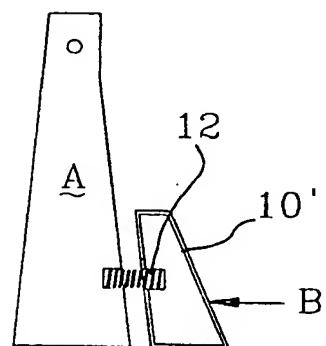


FIG. 8

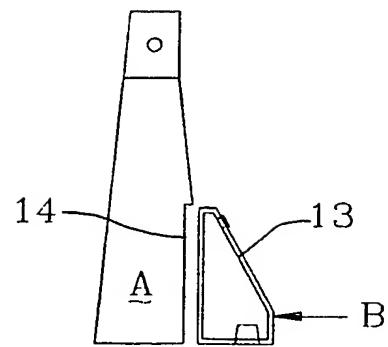


FIG. 9

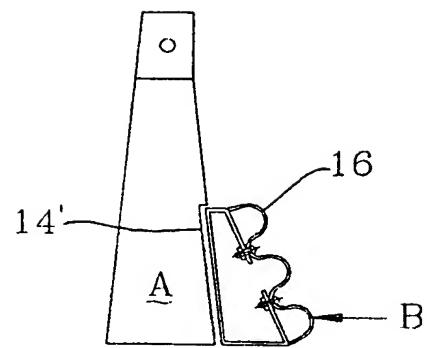


FIG. 10

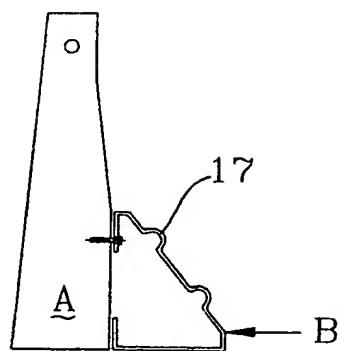


FIG. 12

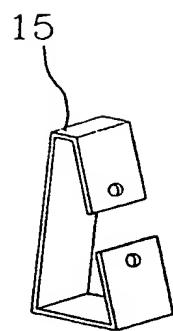


FIG. 11

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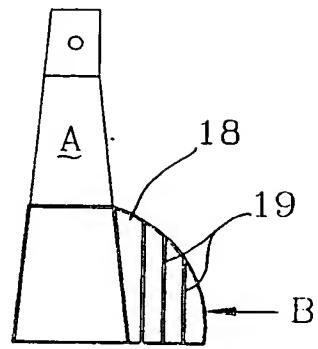


FIG. 13

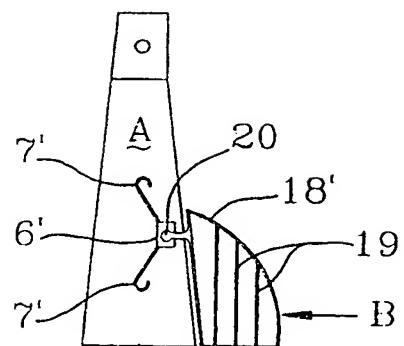


FIG. 14

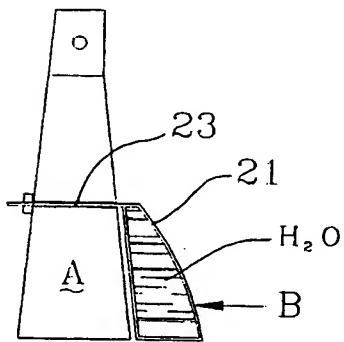


FIG. 15

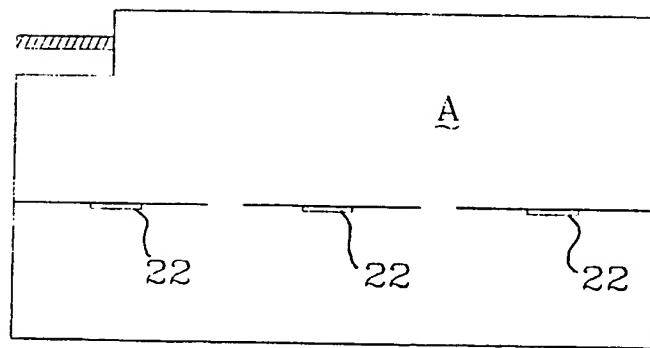


FIG. 16

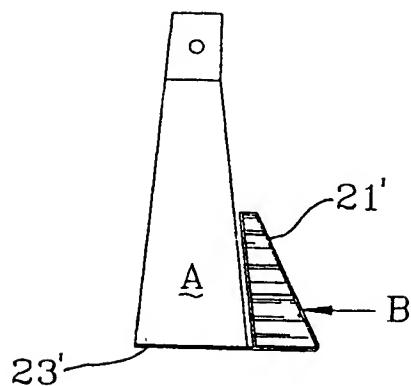


FIG. 17

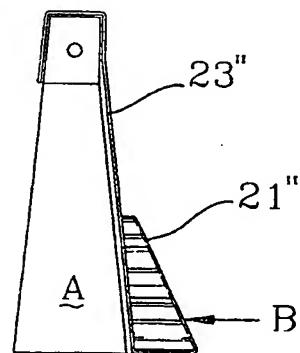


FIG. 18

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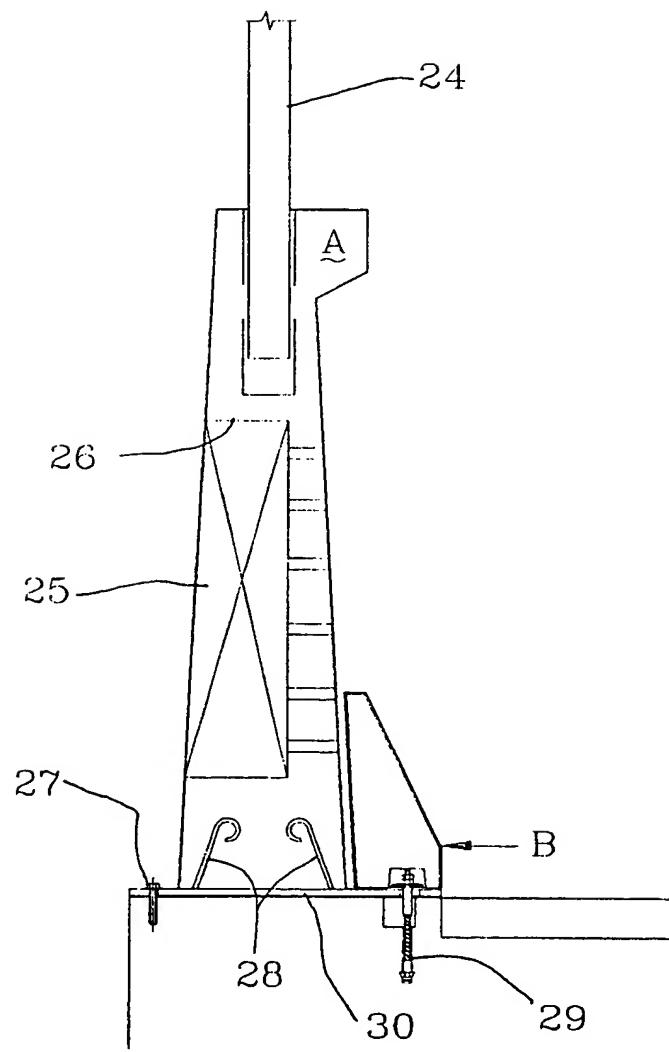


FIG. 19

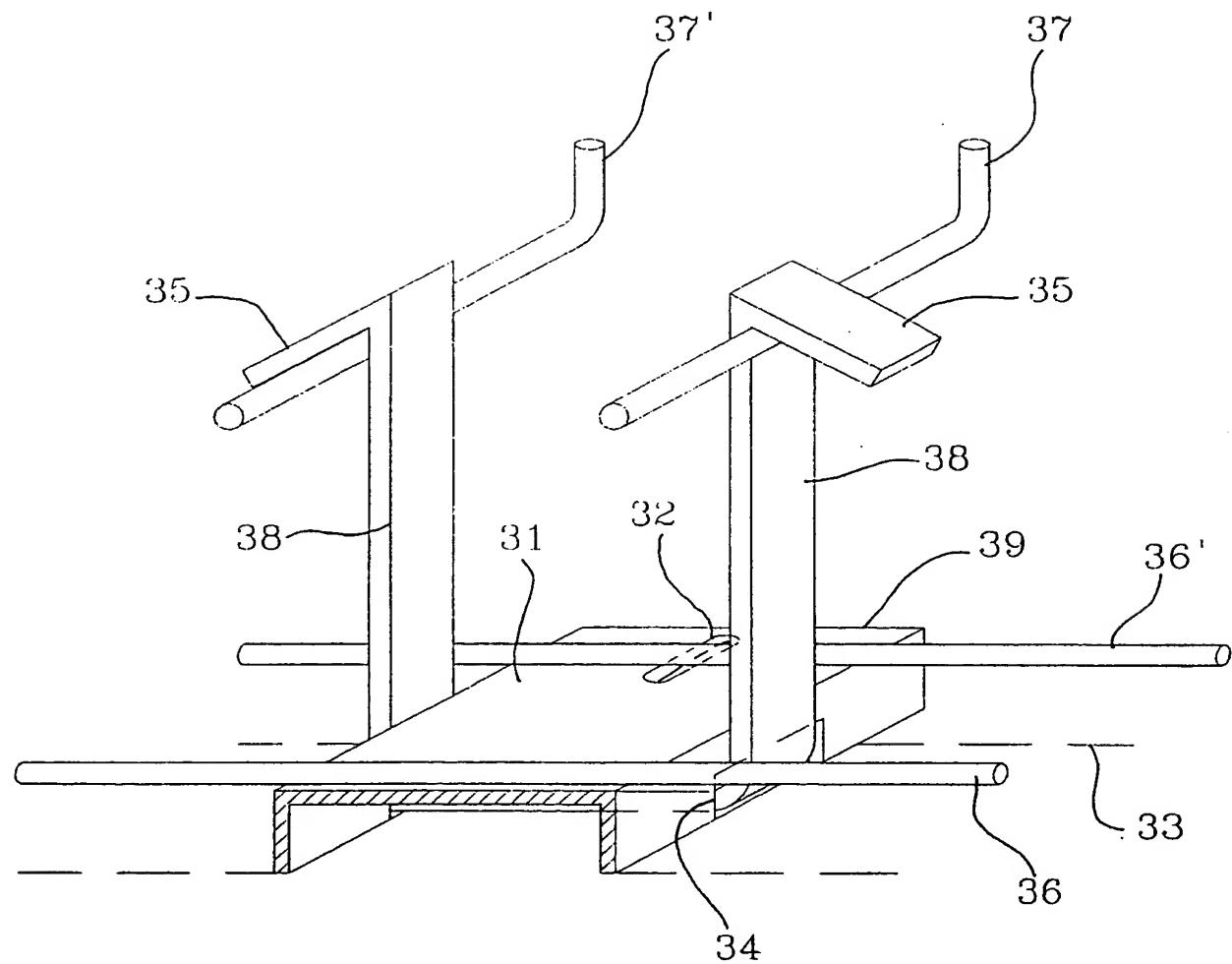


FIG. 20

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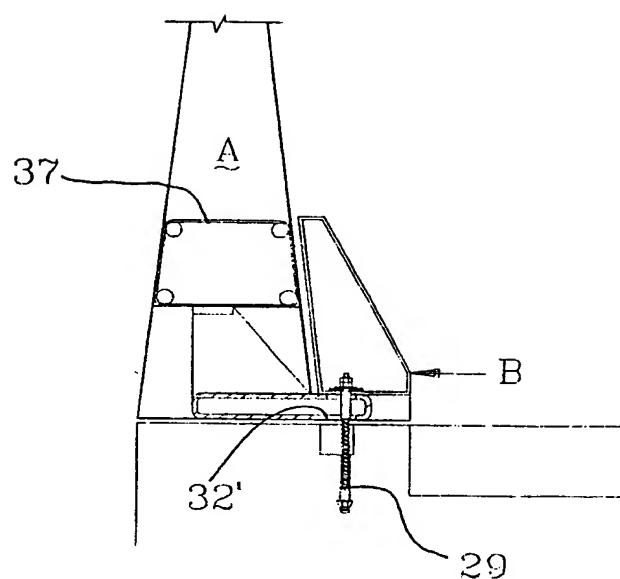


FIG. 21

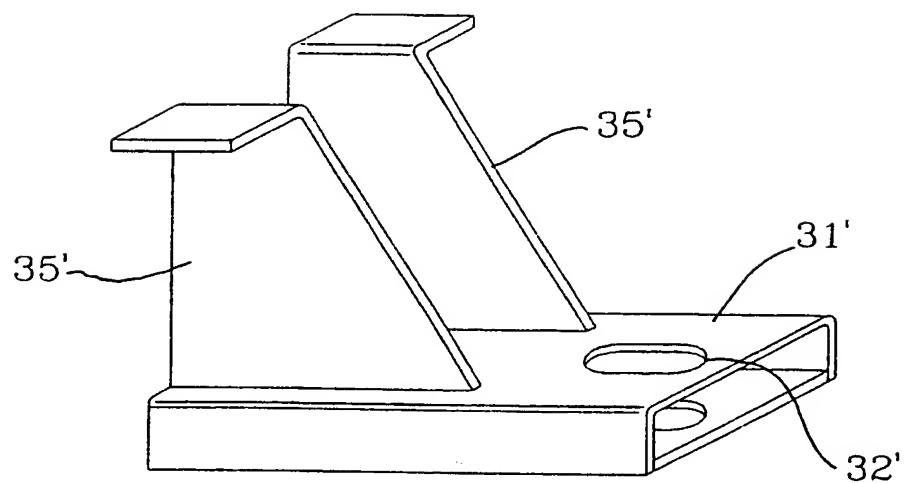


FIG. 22

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 00/00248

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E01F15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 E01F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 95 03453/A (BRUSCHI STEFANO ;MALGARINI MAURO (IT); AUTOSTRADE CONCESS CONST (I) 2 February 1995 (1995-02-02) page 2, line 1 - line 7 page 5, line 6 -page 7, line 7 page 12, line 19 - line 28; figures	1,2,5,7, 8,18
A	US 3 844 538 A (COLAN O) 29 October 1974 (1974-10-29) column 2, line 30 -column 3, line 22; figures	15,16
X	BE 644 358 A (E. BUCHER) 9 July 1964 (1964-07-09)	1,2
Y	page 3, paragraph 3 -page 5, paragraph 4 page 6, paragraph 7 -page 9, paragraph 3; figures	3-5,10
X	---	1,11,14
Y	---	13,15,19
A	---	2,8,17
		-/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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- "&" document member of the same patent family

Date of the actual completion of the international search

10 October 2000

Date of mailing of the international search report

17/10/2000

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Verveer, D

INTERNATIONAL SEARCH REPORT

International Application No

PCT/1T 00/00248

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	column 5, line 47 -column 6, line 39 column 8, line 22 - line 31 column 14, line 17 - line 51; figures	1, 11, 12, 14, 18, 19
Y	GB 1 347 771 A (ETAT FRANCAIS MINISTERE DE LEQ) 27 February 1974 (1974-02-27)	13
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Y	EP 0 518 304 A (FIMIT IPSE SRL) 16 December 1992 (1992-12-16)	19
A	column 2, line 14 - line 34; figures	1, 10, 11
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A	DE 74 20 685 U (H.J. SCHÖMBURG) 31 October 1974 (1974-10-31) the whole document	1, 4
A	DE 15 34 499 A (A. GROS) 26 June 1969 (1969-06-26) the whole document	1, 10, 11, 15
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International Application No

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